

REMARKS

In paragraph 1 of the Office Action it is indicated that Applicant's submission filed on 6/17/03 has been entered. Applicant appreciates the entry of and consideration of Applicant's prior amendment.

In paragraph 2 of the Office Action it is indicated that Applicant's prior arguments have been considered, but are moot in view of new grounds of rejection. Applicant appreciates the Examiner's consideration of Applicant's arguments. With particular reference to the Examiner's comment in paragraph 2 regarding claim 1, Applicant respectfully disagrees therewith, and Applicant further addresses this issue in response to the rejection of claims 1-3 in paragraphs 6 and 7 of the Office Action as set forth herebelow.

In paragraphs 3, 4 and 5 of the Office Action claim 3 is rejected under 35 U.S.C. 112, second paragraph as being indefinite, for reasons stated therein. Responsive thereto, Applicant has cancelled claim 3 herein.

In paragraphs 6 and 7 of the Office Action claims 1-3 and 11 are rejected under 35 U.S.C. 102(b) as being anticipated by Roth et al (5,272,117), stating:

"As to claims 1 and 3, Roth et al teach that a plurality of upwardly projecting components(14) are formed on a substrate (12) and a polish-stop layer (18) is formed over the components (col. 3, lines 5-18 and lines 51-52 and figure 2).

Roth et al also teach that a polishable layer (20) is deposited above the etch-stop layer (col. 4, lines 5-8).

Roth et al, teach that a polishing step is performed for planarizing the polishable layer at a point in time wherein the polish-stop layer is exposed using a polishing slurry in a chemical mechanical polishing (CMP) process (col. 4, lines 14-18, lines 38-41).

Roth et al, further teach that a portion of the stop layer is removed subsequent to the polishing step (col. 6, lines 18-24 and Figures 8-9).

As to claim 2, Roth et al teach that the polish-stop layer polishes at a slower rate than the material to be polished (col. 3, lines 51-55). So, the polish-stop layer is more resistant to the polishing slurry compare to the polishable layer.

As to claim 11, Roth et al. teach that the etch-stop layer is polished at a slower rate than the polishable layer (col. 3, lines 52-54)."

Additionally, in paragraph 2 of the Office Action it is stated:

“Applicants argue that Roth et al do not teach that the last step of claim 1 such as “removing portions of said stop layer subsequent to said polishing step”.

This is not persuasive because Roth et al clearly teach that after polishing the polishable layer, portions of the etch stop layer is removed (col. 6, lines 18-20 and also see the figures 8-9).”

Responsive thereto, Applicant again respectfully traverses this ground of rejection and Applicant asserts that the claims are not anticipated by Roth ‘117. Specifically, Applicant believes that Roth is misinterpreted by the Examiner in the comment quoted above that “Roth et al further teach that a portion of the stop layer is removed subsequent to the polishing step (col. 5, lines 10-11).” Particularly, in paragraph 2 of the Office Action the Examiner references Figs. 8-9 of Roth et al. These figures, and the specification describing these figures, likewise do not support the Examiner’s position, as is next discussed.

Specifically, with reference to Figs. 8 and 9 of Roth it is seen in Fig. 9, and described in column 6, lines 18-20 (specifically cited by the Examiner) that the etch stop layer 18 is removed PRIOR to any CMP step (that CMP step being particularly depicted in Figs. 10 and 11). Therefore, Applicant continues its assertion that the Examiner has misunderstood the teachings of Roth, and that Roth does not teach the last limitation of claim 1, which states: “removing portions of said stop layer subsequent to said polishing step.”

Applicant notes that the remaining paragraphs of the rejection are directly copied from the last Office Action, and responsive thereto, Applicant next copies its prior response to those paragraphs of the prior rejection. Applicant does this because Applicant believes that its arguments therein clearly distinguish the teachings of Roth.

With regard to the last limitation in amended independent claim 1, which states: “removing portions of said stop layer subsequent to said polishing step.” this step is not taught by Roth. Specifically, with regard to the teachings of Roth, Applicant has submitted herewith copies of Figs. 1-11 of Roth that are shaded for ease of Applicant’s explanation. With regard to Applicant’s shaded figures, commencing with Figs. 2-6, as described in col. 3, line 51, an etch stop layer 18 (shaded) is formed overlying a layer of material 16 that is deposited on top of components 14. Thereafter, with reference to Fig. 3, an etching process is undertaken to remove generally horizontal portions of the etch stop layer 18, such that sidewall portions of the stop layer 18 remain, as is described in col. 3, line 63 - col. 4, line 4. Thereafter, a layer 20 of

polishable material is deposited as is depicted in Fig. 4 and described in col. 4, lines 5-14. Thereafter, as depicted in Fig. 5, a CMP step is used to remove portions of the polishable layer 20 down to the etch stop layer 18 (shaded), as described in col. 4, lines 14-20. As is next depicted in Fig. 6, further components, such as interconnects 22 are fabricated on top of the planarized surface as is described in col. 5, lines 61-68.

Therefore, it is clear that Roth et al Figs. 1-6 does not teach the removal of portions of the etch stop layer 18 (blue) subsequent to the CMP step, and the only step in which portions of the stop layer 18 are removed are depicted in Fig. 3 which is prior to the CMP step. This is opposite the contention of the Examiner that “Roth et al, further teach that a portion of the stop layer is removed subsequent to the polishing step (col. 5, lines 10-11).”

With regard to the comment in Roth, col. 5, lines 10-11 referenced in the Office Action, it states:

“In Fig. 5, the etch stop layer is removed from the contact regions and remains only on sidewall areas.”

Applicant submits that this comment of Roth is a statement describing the generalized state of Roth device after the planarization step depicted in Fig. 5. It is a general comment and it must be understood as follows:

“In Fig. 5 the device is depicted in which the etch stop layer is removed in the step depicted in Fig. 3 from the contact regions and remains only on sidewall areas.” [Applicant additions underlined]

When this sentence (col. 5, lines 10-11) is interpreted as stated immediately above, it is entirely consistent with the figures and the remainder of the description of Roth et al. Conversely, if this sentence is interpreted as urged by the Examiner, it is inconsistent with the figures and the description provided in the specification, because no portion of the etch stop layer is taught in Roth to be removed subsequent to the CMP step.

With particular reference to Roth Figs. 7-9, and the description in col. 6, lines 5-50, it is seen that the polish stop layer 18 (shaded) is etched in Fig. 8 to the configuration depicted in Fig. 9. Thereafter, as depicted in Figs. 10 and 11, a CMP process is undertaken down to the level of the polish stop layer 18 (see Fig. 11). Significantly, thereafter, Roth teaches nothing with regard to the removal of the polish stop layer 18 subsequent to the CMP step. Applicant therefore continues to assert that Roth fails to teach this limitation as set forth in independent claim 1.

Applicant therefore submits that Roth does not teach the limitation of claim 1 that portions of the stop layer are removed subsequent to the polishing step. Therefore, Roth does not anticipate the last of the limitations of amended independent claim 1.

With regard to dependent claims 2 and 11, Applicant asserts that they are allowable in that they depend from an allowable base claim. Dependent claim 3 has been cancelled herein.

In paragraphs 8, 9 and 10 of the Office Action claims 5-7,9-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roth (5,272,117) as applied to claims 1-3 above, and further in view of Cheng et al (6,086,777), stating:

“Roth et al discussed above in the paragraph No 7 above and also disclose that the stop layer could comprises diamond or tantalum containing layer or any other etch stop layer (col. 3, lines 55-59).”

Roth et al fail to teach the etch stop layer having a desired thickness of 200-500 angstroms.”

However, in a method of making interconnect, Cheng et al teach that a polishing stop layer (18) of tantalum (18) having a thickness range from about 300 to about 500 angstroms, which is sufficient for efficiently preventing conductive material from diffusing into the diffusion region or into the component regions (col. 5, lines 36-42).”

Therefore, it would have been obvious to one ordinary skilled in the art at the time of claimed invention to combine Cheng et al’s teaching into Roth et al’s teaching for preventing conductive material from diffusing into the diffusion region or into the component regions as taught by Cheng et al.

As to claims 9-10, Cheng et al teach that a portion of the polish-stop layer using ion-etching process, wherein the etching gas comprises argon (col. 3, lines 64-col. 4, lines 3 and col. 5, lines 17-20).”

With regard to dependent claims 5-7, 9-10, Applicant notes that these claims are dependent, either directly or indirectly, upon amended independent claim 1, and based thereon, Applicant asserts that these claims are allowable.

In paragraph 11 of the Office Action claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Roth et al (5,272,117) in view of Cheng et al. (6,086,777), and further in view of Jaso et al (5,246,884), stating:

“Modified Roth et al discussed above in the paragraph No 10 above and also teach that the etch-stop or polish-stop layer could comprises diamond (col. 3, lines 51-58).

As to claims 12-13, Roth et al fail to teach that the polish-stop layer is diamond-like-carbon (DLC).

In a method of using an etch-stop or polish-stop layer, Jaso et al teach that diamond or diamond-like-carbon (DLC) can be used as an etch stop layer (col. 3, lines 24-28). Jaso et al also teach that the stop layer is removed by a reactive ion etching such as oxygen ashing process (col. 3, lines 53-55 and col. 4, lines 52-53).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to employ Jaso et al's teaching into Roth et al's method because both the diamond and diamond-like-carbon (DLC) are functionally equivalent as taught by Jaso et al.

With regard to dependent claims 12 and 13, Applicant asserts that these claims are allowable in that they depend, either directly or indirectly from an allowable independent claim 1, as is discussed hereabove.

In paragraph 12 of the Office Action claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Roth et al (5,272,117) in view of Jaso et al (5,246,884), and further in view of Martin et al (5,707,409), stating:

"Modified Roth et al discussed in the paragraph 11 above but fail to teach that the thickness of the DLC is in the range of approximately 200 Angstroms.

However, in a method of hard carbon coating, Martin et al teach that most preferable thickness of a DLC film is in the range of 100 to 5000 Angstroms. Martin et al also teach that it is expensive to make a thicker film and also becomes brittle and lose adhesion (col. 8, lines 20-31).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Martin et al's teaching into modified Roth et al's teaching in order to form a DLC film with lower thickness such as approximately 200 Angstroms because thicker film becomes relatively expensive, brittle and lose adhesion as taught by Martin et al."

Responsive thereto, Applicant respectfully traverses this ground of rejection and asserts that Martin fails to teach or render obvious the use of a DLC layer as an etch stop layer having a thickness in the range of approximately 200 Å. Particularly, Martin '407 teaches an abrasive article having a DLC layer is used as a top coat or as a layer that is located between the abrasive coating and a covering layer. Thus, the teachings of Martin basically amount to the simple indication that a DLC layer can be formed having a 200 Å thickness. There is no teaching in Martin that such a layer will act efficaciously as a polishing stop layer in a CMP process. Based

thereon, Applicant submits that claim 8 recites patentable subject matter. Additionally, Responsive thereto, Applicant notes that claim 8 is a dependent claim, and Applicant asserts that it is allowable in that it depends indirectly from allowable independent base claim 1.

In paragraph 13 of the Office Action claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Roth et al (5,272,117), as applied to claims 1-3 above, and further in view of Yang et al (6,153,116), stating:

“Modified Roth et al discussed above in the paragraph 6 but fail to teach that the end point of the CMP process is determined by monitoring a polishing motor current.

However, in a method of end point detection of a CMP process, Yang et al teach that it is conventional to monitor the polishing motor current in order to detect an end point of a CMP process (col. 3, lines 45-67).

Therefore, it would have been obvious to one skilled in the art at the time of claimed invention to combine Yang et al’s teaching into modified Roth et al’s process for efficiently detecting the end point of the polishing process as taught by Yang et al.”

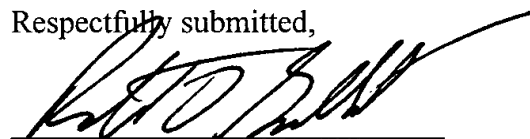
Responsive thereto, Applicant notes that claim 14 is a dependent claim, and Applicant asserts that it is allowable in that it depends indirectly from allowable independent base claim 1.

In paragraphs 14 and 15 of the Office Action it is indicated that claims 15, 17-27, 29-38 are allowable, and a statement of reasons for allowance is provided herewith. Applicant concurs in the statement of reasons for allowance.

Having responded to all of the paragraphs of the Office Action, and having amended the claims accordingly, Applicant respectfully submits that the Application is now in condition for allowance. Applicant therefore respectfully requests that a Notice of Allowance be forthcoming

at the Examiner's earliest opportunity. Should the Examiner have any questions or comments with regard to this amendment, a telephonic conference at the number set forth below is respectfully requested.

Respectfully submitted,



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CERTIFICATE OF MAILING (37 CFR 1.8(a))

I hereby certify that this paper (along with any referred to as being attached or enclosed) is being deposited on November 26, 2003 with the U.S. Postal Service as first class mail in an envelope addressed to: MS Non Fee Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Date: November 26, 2003


Patricia Beilmann

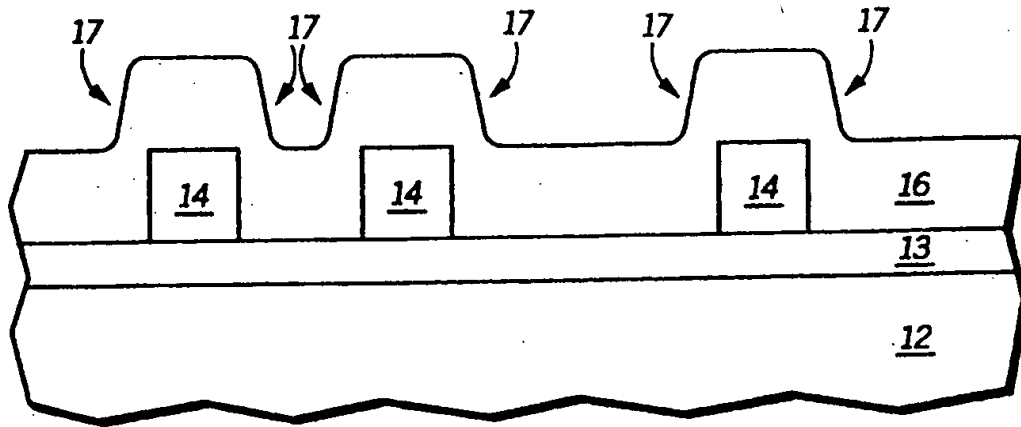


FIG. 1

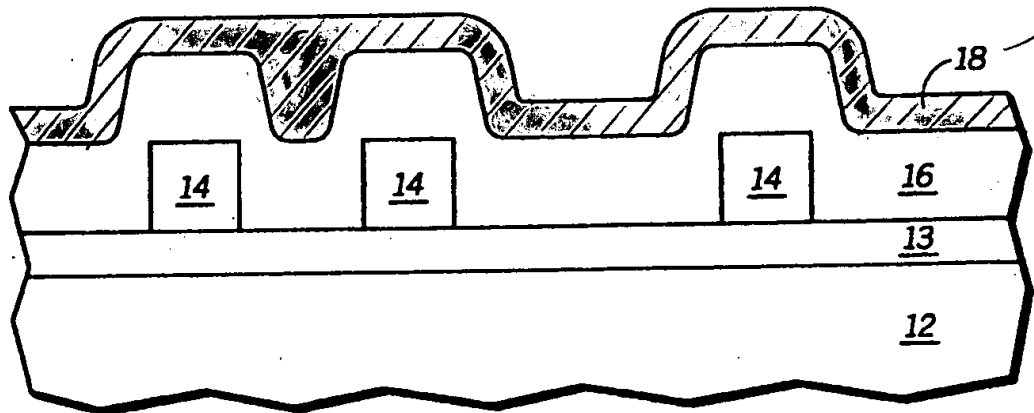


FIG. 2

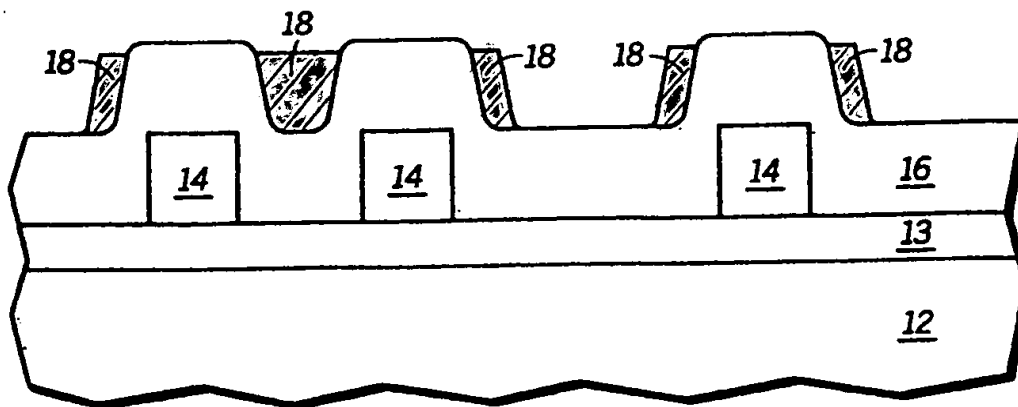


FIG. 3

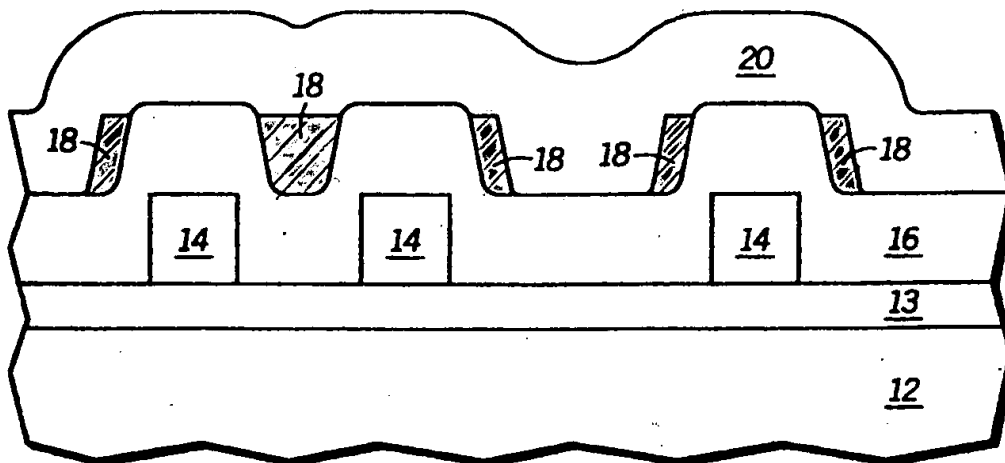


FIG. 4

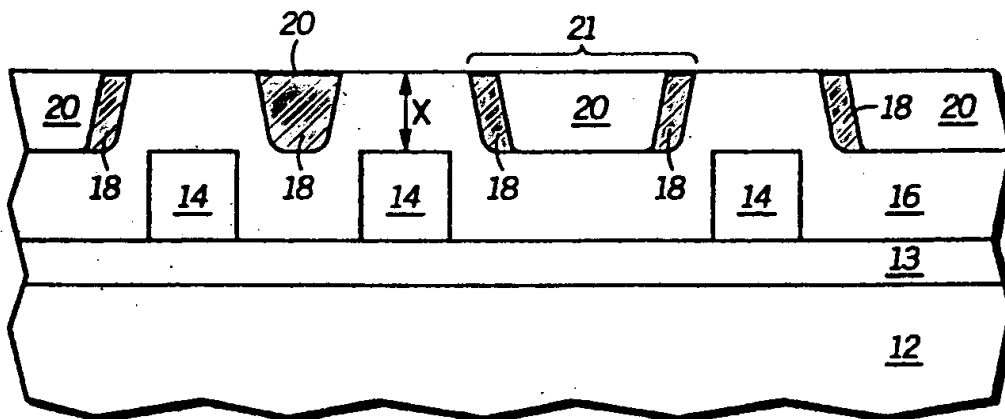


FIG. 5

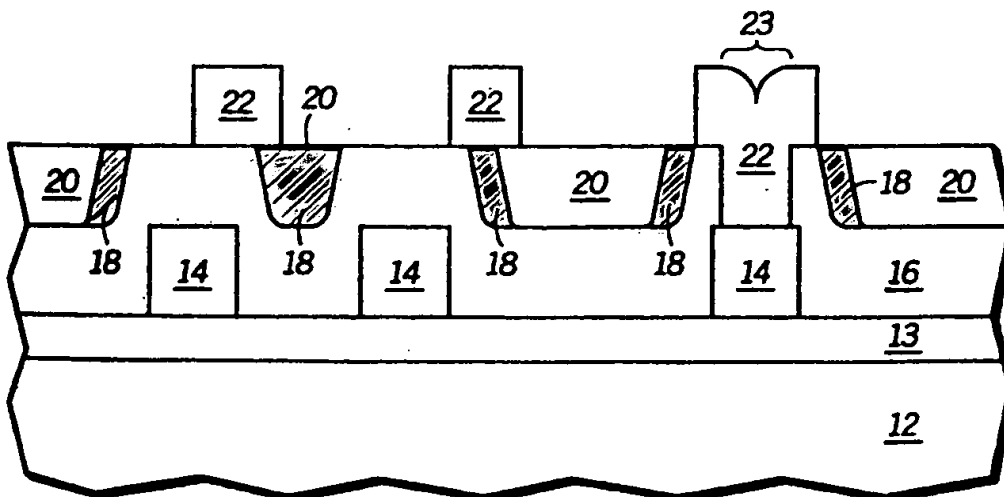


FIG. 6

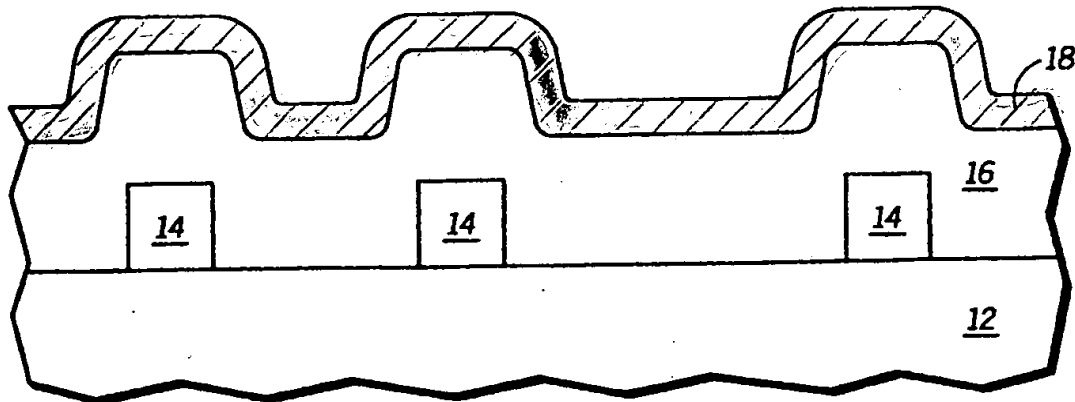


FIG. 7

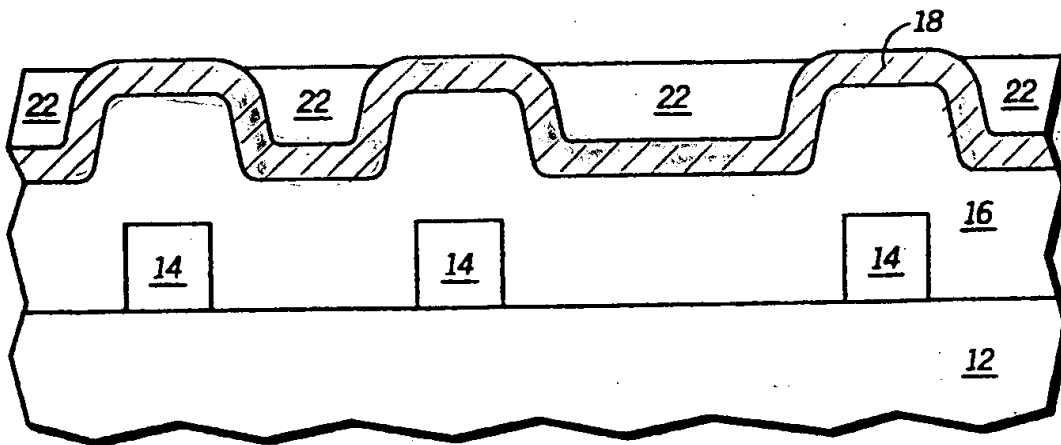


FIG. 8

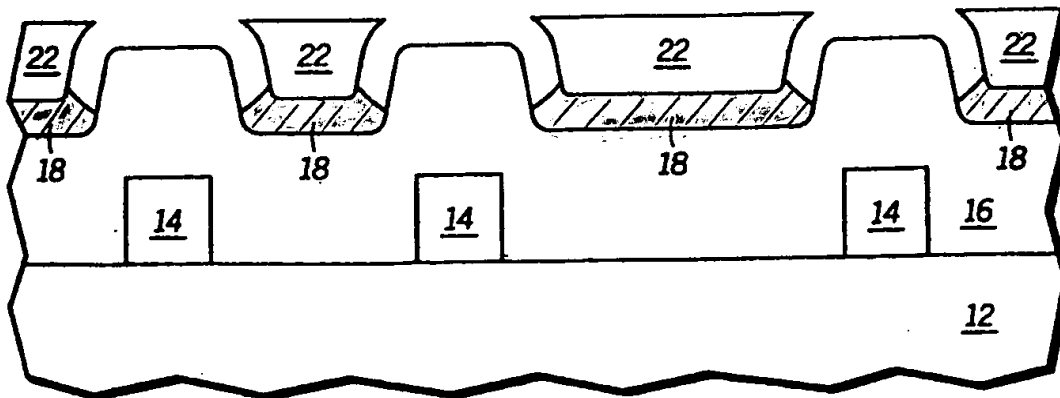


FIG. 9

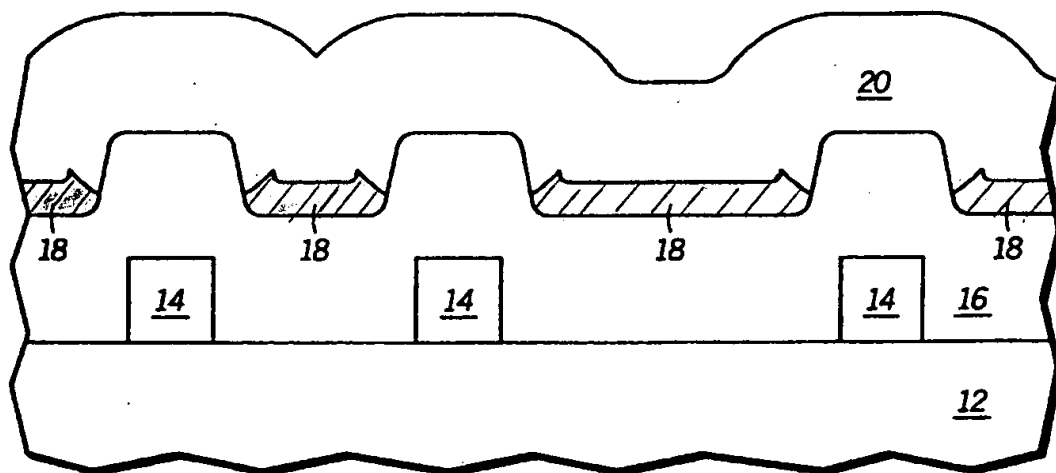


FIG. 10

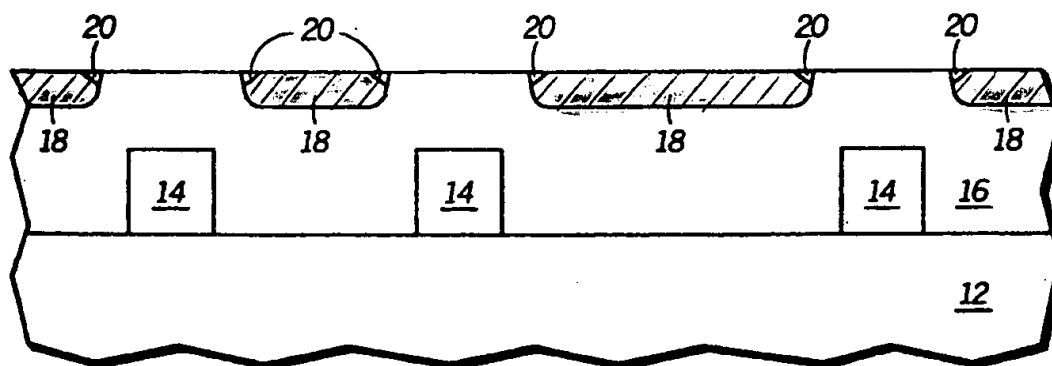


FIG. 11